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Wavelength measurements in the spectrum of a mercury arc at different voltages

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With one plate

SUMMARY

The wavelengths of the lines emitted by a mercury arc when it is run at different voltages (20 and 70 volts) have been measured. The shifts of the various lines have been derived by comparing the results obtained at the two voltages with the results from some earlier investigations where the shifts may be assumed to be negligible. The actual wavelengths emitted by the lamp at 70 volts were needed for an investigation of the dispersion of air.

In an investigation of the dispersion of air, which was recently carried out by one of the authors (K.-F. S.), a mercury arc was used as a light source. The lamp was labelled "Heraeus Quarzglas, 3.5 A, 120 V, G.m.b.H. Hanau", the length of the discharge tube was 6 cm and the diameter 1.5 cm. This light source was chosen because of its high intensity and favourable distribution of lines over the spectrum region concerned. However, since the wavelengths of the lines used in the dispersion measurements must be known fairly accurately and many of the lines are appreciably shifted with a change in the discharge conditions, it became necessary to determine the actual wavelengths at the conditions under which the lamp was used in the dispersion work.

In the dispersion measurements one must balance the claim for high intensity with the claim for reasonably sharp lines. In the first place, therefore, the most favourable conditions for running the mercury lamp were determined by observing the spectrum at different voltages over the lamp. The lowest voltage at which the lamp could be run was 20 V. Observations were made at voltages increased by steps of 10 V, from 20 to 90 V. It was then found that for the lower voltages the intensity increased with the voltage without any appreciable deterioration in the quality of the lines. At the two highest voltages, however, a great many of the lines became much more diffuse and broad, while their intensity increased only moderately. Therefore, 70 V was chosen as a suitable working voltage. No special arrangements were made for cooling the lamp. When stationary temperature conditions had been attained, the current was 2.65 A. With 20 V the current was 2.25 A. The ratio between the intensities for a given line at 20 and 70 V was on an average 1:80.

The spectrum was recorded with a Jarrell-Ash spectrograph with the plate factor 5 Å/mm. Some recordings were made with another concave grating spectrograph, plate factor 7.5 Å/mm, described by Lidén (1949). On each plate two exposures were

Table 1. Wavelengths in a mercury arc.

References to previous measurements:

BAL = Burns, Adams and Longwell (1950). Geissler tube with about 0.2 mg Hg/cm^3; current 20 mA, neon pressure 6 mm Hg.
Cn = Cardaun (1915). 1. Quartz vacuum lamp 4 A, 90 V. 2. Condensed spark, carbon electrodes containing mercury.
F = Fowles (1954). Electrodeless discharge tube containing pure mercury vapour. Excitation by a 25-watt 250-Mc oscillator. Reference lines from a Meggers Hg^{198} lamp.
MIT = MIT Wavelength Tables (1939).
S = Stiles (1909). Mercury arcs.

All the lines of the third column are more or less widened. The sharpest lines are designated with *s*, the most diffuse ones with *d* or *vd* (very diffuse).

λ_{air}, Å			$\Delta\lambda$, Å		Combination in Hg I
Previous measurements	Present investigation		70V–BAL or 70V–F	70V–20V	
	20 V	70 V			
7091.860 (F)	1.88	2.09	+0.23	+0.21	$7s\,^3S_1-\;8p\;^3P^o_0$
7081.901 (F)	1.93	2.10	+0.20	+0.17	$7s\,^3S_1-\;8p\;^3P^o_1$
6907.47 (S)	7.50	7.75		+0.25	$7s\,^3S_1-\;8p\;^3P^o_2$
6716.315 (S)	6.39	6.44 *s*		+0.05	$7s\,^1S_0-\;6p'\,^1P^o_1$
6234.37 (MIT)	4.39	4.37		−0.02	$7s\,^1S_0-\;9p\;^1P^o_1$
6123.48 (S)	3.49	3.49 *s*		0.00	$7s\,^3S_1-\;6p'\,^1D^o_2$
6072.64 (MIT)	2.66	2.71		+0.05	$7s\,^3S_1-\;6p'\,^1P^o_1$
5871.975 (F)	1.99	2.73 *d*	+0.75	+0.74	$7s\,^3S_1-\;9p\;^3P^o_0$
5859.254 (F)	9.28	9.62 *d*	+0.37	+0.34	$7s\,^3S_1-\;9p\;^3P^o_1$
5790.6630 (BAL)	0.66	0.64	−0.02	−0.02	$6p\,^1P^o_1-\;6d\;^1D_2$
5769.5982 (BAL)	9.60	9.56	−0.04	−0.04	$6p\,^1P^o_1-\;6d\;^3D_2$
5675.	5.91	5.89		−0.02	$7s\,^3S_1-\;9p\;^1P^o_1$
5460.7348 (BAL)	0.74	0.73	0.00	−0.01	$6p\,^3P^o_2-\;7s\;^3S_1$
5354.290 (S)	4.14	5.00 *vd*		+0.86	$7s\,^3S_1-10p\,^3P^o_2$
5025.568 (S)	5.63	5.65 *s*		+0.02	$6p\,^1P^o_1-\;8s\;^3S_1$
4960.	0.19	0.14 *d*		−0.05	
4916.068 (BAL)	6.09	6.08	+0.01	−0.01	$6p\,^1P^o_1-\;8s\;^1S_0$
4358.3277 (BAL)	8.36	8.37	+0.04	+0.01	$6p\,^3P^o_1-\;7s\;^3S_1$
4347.4945 (BAL)	7.50	7.52	+0.03	+0.02	$6p\,^1P^o_1-\;7d\;^1D_2$
4339.2232 (BAL)	9.23	9.28	+0.06	+0.05	$6p\,^1P^o_1-\;7d\;^3D_2$
4108.054 (BAL)	8.08	8.17 *s*	+0.12	+0.09	$6p\,^1P^o_1-\;9s\;^1S_0$
4077.8314 (BAL)	7.83	7.84 *s*	+0.01	+0.01	$6p\,^3P^o_1-\;7s\;^1S_0$

(Table 1, cont.)

λ_{air}, Å			$\Delta\lambda$, Å		Combination in Hg I
Previous measurements	Present investigation		70V–BAL or 70V–F	70V–20V	
	20 V	70 V			
4046.5630 (BAL)	6.57	6.59 *s*	+0.03	+0.02	$6p\,^3P_0^o-7s\,^3S_1$
3983.997 (Cn, 1)	3.97	3.96 *s*		−0.01	Hg II
3906.371 (BAL)	6.42	6.62 *d*	+0.25	+0.20	$6p\,^1P_1^o-8d\,^1D_2$
3903.638 (MIT)	3.65				$6p\,^1P_1^o-8d\,^3D_1$
3901.868 (BAL)	1.89	2.09	+0.22	+0.20	$6p\,^1P_1^o-8d\,^3D_2$
3894.		4.14			$6p\,^1P_1^o-6f\,^3F_2^o$?
3860.	0.85 *d*	0.88 *d*		+0.03	
3820.	0.40 *d*	0.44 *d*		+0.04	
3801.6583 (BAL)	1.66	1.65 *s*	−0.01	−0.01	$6p\,^1P_1^o-10s\,^1S_0$
3790.	0.00 *d*	89.96 *d*		−0.04	
3770.		0.90 *d*			
3751.737 (S)	1.78	1.72 *s*		−0.06	
3704.1655 (BAL)	4.20	4.62 *vd*	+0.45	+0.42	$6p\,^1P_1^o-9d\,^1D_2$
3701.442 (MIT)	1.46				$6p\,^1P_1^o-9d\,^3D_2$
3680.		0.31			$6p\,^3P_2^o-7p\,^3P_2^o$
3663.2793 (BAL)	3.28	3.28	0.00	0.00	$6p\,^3P_2^o-6d\,^1D_2$
3662.879 (BAL)	2.89	2.90	+0.02	+0.01	$6p\,^3P_2^o-6d\,^3D_1$
3654.8363 (BAL)	4.81	4.80	−0.04	−0.01	$6p\,^3P_2^o-6d\,^3D_2$
3650.1533 (BAL)	0.15	0.14 *d*	−0.01	−0.01	$6p\,^3P_2^o-6d\,^3D_3$
3592.97 (S)	2.78				$6p\,^1P_1^o-10d\,^1D_2$
3561.203 (S)		1.22			
3543.70 (S)	3.46	3.42 *d*		−0.04	
3390.		0.71 *d*			
3351.61 (S)		1.56			
3341.4766 (BAL)	1.48	1.51	+0.03	+0.03	$6p\,^3P_2^o-8s\,^3S_1$
3144.		4.28			$6p\,^3P_1^o-7p\,^3P_2^o$
3135.		5.66 *d*			
3131.8391 (BAL)	1.84	1.84 *d*	0.00	0.00	$6p\,^3P_1^o-6d\,^1D_2$
3131.5485 (BAL)	1.54	1.55 *d*	0.00	+0.01	$6p\,^3P_1^o-6d\,^3D_1$
3125.6681 (BAL)	5.67	5.65 *d*	−0.02	−0.02	$6p\,^3P_1^o-6d\,^3D_2$
3049.		9.85 *d*			$6p\,^3P_2^o-8p\,^3P_2^o$
3038.		8.45			$6p\,^3P_2^o-6p'\,^3F_4^o$?
3027.487 (BAL)	7.50	7.51	+0.02	+0.01	$6p\,^3P_2^o-7d\,^1D_2$
3025.606 (BAL)	5.63	5.64	+0.03	+0.01	$6p\,^3P_2^o-7d\,^3D_1$
3023.475 (BAL)	3.49	3.49	+0.01	0.00	$6p\,^3P_2^o-7d\,^3D_2$
3021.498 (BAL)	1.52	1.54 *d*	+0.04	+0.02	$6p\,^3P_2^o-7d\,^3D_3$
3011.		1.48			$6p\,^3P_2^o-5f\,^3F_3^o$?
3007.		7.14			$6p\,^3P_2^o-5f\,^3F_4^o$?

(Table 1, cont.)

λ_{air}, Å			$\Delta\lambda$, Å		Combination in Hg I
Previous measurements	Present investigation		70V–BAL or 70V–F	70V–20V	
	20 V	70 V			
2967.543 (BAL)	7.55	7.53 *d*	−0.01	−0.02	$6p\,^3P^o_0-\ 6d\,^1D_2$
2967.280 (BAL)	7.27	7.29 *d*	+0.01	+0.02	$6p\,^3P^o_0-\ 6d\,^3D_1$
2925.410 (BAL)	5.40	5.44	+0.03	+0.04	$6p\,^3P^o_2-\ 9s\,^3S_1$
2893.594 (BAL)	3.58	3.61	+0.02	+0.03	$6p\,^3P^o_1-\ 8s\,^3S_1$
2856.935 (BAL)	6.94	6.95 *s*	+0.01	+0.01	$6p\,^3P^o_1-\ 8s\,^1S_0$
2820.0 (Cn, 2)		0.15 *vd*			
2810.		0.72 *vd*			$6p\,^3P^o_2-\ 9p\,^3P^o_2$?
2806.759 (BAL)	6.76	6.83 *d*	+0.07	+0.07	$6p\,^3P^o_2-\ 8d\,^1D_2$
2805.344 (BAL)	5.34	*vd*			$6p\,^3P^o_2-\ 8d\,^3D_1$
2804.434 (BAL)	4.46	4.51 *d*	+0.08	+0.05	$6p\,^3P^o_2-\ 8d\,^3D_2$
2803.465 (BAL)	3.46	3.55 *vd*	+0.08	+0.09	$6p\,^3P^o_2-\ 8d\,^3D_3$
2799.76 (Cn, 2)		9.77 *vd*			
2759.706 (BAL)	9.72	9.77 *s*	+0.06	+0.05	$6p\,^3P^o_2-10s\,^3S_1$
2752.778 (BAL)	2.78	2.79 *s*	+0.01	+0.01	$6p\,^3P^o_0-\ 8s\,^3S_1$
2699.514 (BAL)	9.39	*vd*			$6p\,^3P^o_2-\ 9d\,^3D_2$
2698.828 (BAL)	8.85 *d*	*vd*			$6p\,^3P^o_2-\ 9d\,^3D_3$
2674.908 (BAL)	4.92	4.95	+0.04	+0.03	$6p\,^3P^o_2-11s\,^3S_1$
2655.127 (BAL)	5.13	5.14	+0.01	+0.01	$6p\,^3P^o_1-\ 7d\,^1D_2$
2653.679 (BAL)	3.67	3.70	+0.02	+0.03	$6p\,^3P^o_1-\ 7d\,^3D_1$
2652.039 (BAL)	2.04	2.07	+0.03	+0.03	$6p\,^3P^o_1-\ 7d\,^3D_2$
2639.780 (BAL)	9.81	*vd*			$6p\,^3P^o_2-10d\,^3D_3$
2625.192 (BAL)	5.20	*vd*			$6p\,^3P^o_2-12s\,^3S_1$
2603.	3.04 *d*				$6p\,^3P^o_2-11d\,^3D_3$
2576.285 (BAL)	6.31	6.34	+0.05	+0.03	$6p\,^3P^o_1-\ 9s\,^3S_1$
2534.764 (BAL)	4.77	4.77 *d*	+0.01	0.00	$6p\,^3P^o_0-\ 7d\,^3D_1$
2483.815 (BAL)	3.83	3.88 *d*	+0.06	+0.05	$6p\,^3P^o_1-\ 8d\,^1D_2$
2482.710 (BAL)	2.71	2.76 *d*	+0.05	+0.05	$6p\,^3P^o_1-\ 8d\,^3D_1$
2481.996 (BAL)	2.00	2.06 *d*	+0.06	+0.06	$6p\,^3P^o_1-\ 8d\,^3D_2$
2464.057 (BAL)	4.05	4.07 *s*	+0.01	+0.02	$6p\,^3P^o_0-\ 9s\,^3S_1$
2446.895 (BAL)	6.90	6.91 *s*	+0.01	+0.01	$6p\,^3P^o_1-10s\,^3S_1$
2399.727 (BAL)	9.74	} 9.54 *vd*			$6p\,^3P^o_1-\ 9d\,^3D_1$
2399.453 (BAL)	9.36				$6p\,^3P^o_1-\ 9d\,^3D_2$
2378.316 (BAL)	8.33	8.38	+0.06	+0.05	$6p\,^3P^o_0-\ 8d\,^3D_1$
2352.48 (Cn, 1)	2.45	2.53 *vd*		+0.08	$6p\,^3P^o_1-10d\,^3D_2$
2345.433 (BAL)		5.45 *s*	+0.02		$6p\,^3P^o_0-10s\,^3S_1$
2302.059 (BAL)	2.08	2.18 *d*	+0.12	+0.10	$6p\,^3P^o_0-\ 9d\,^3D_1$
2283.		3.93			$6p\,^3P^o_0-11s\,^3S_1$
2258.77 (MIT)	8.74				$6p\,^3P^o_0-10d\,^3D_1$

Table 2. Line shifts in the Hg I spectrum emitted by a mercury arc at different conditions.

λ, Å	Combination	$\Delta\sigma$, K			$\Delta\lambda$, Å 70V–20V	Main perturbing term, sign of Stark shift $\Delta\lambda$
		20V–ref	70V–ref	70V–20V		
4046	$6p\,{}^3P^o_0 -\ 7s\,{}^3S^1$	−0.05	−0.17	−0.12	+0.02	
4358	${}^3P^o_1 -\ {}^3S_1$	−0.22	−0.28	−0.06	+0.01	
5460	${}^3P^o_2 -\ {}^3S_1$	−0.04	−0.01	+0.03	−0.01	
2752	$6p\,{}^3P^o_0 -\ 8s\,{}^3S_1$	0.0	−0.1	−0.1	+0,01	$8p\,{}^3P^o$, +
2893	${}^3P^o_1 -\ {}^3S_1$	+0.1	−0.2	−0.4	+0.03	
3341	${}^3P^o_2 -\ {}^3S_1$	0.0	−0.3	−0.3	+0.03	
5025	${}^1P^o_1 -\ {}^3S_1$	(−0.1)	(−0.1)	−0.1	+0.02	
2464	$6p\,{}^3P^o_0 -\ 9s\,{}^3S_1$	+0.1	−0.3	−0.3	+0.02	$9p\,{}^3P^o$, +
2576	${}^3P^o_1 -\ {}^3S_1$	−0.4	−0.8	−0.5	+0.03	
2925	${}^3P^o_2 -\ {}^3S_1$	0.0	−0.4	−0.5	+0.04	
2345	$6p\,{}^3P^o_0 - 10s\,{}^3S_1$		−0.3			$10p\,{}^3P^o$, +
2446	${}^3P^o_1 -\ {}^3S_1$	−0.1	−0.3	−0.2	+0.01	
2759	${}^3P^o_2 -\ {}^3S_1$	−0.3	−1.0	−0.7	+0.05	
2283	$6p\,{}^3P^o_0 - 11s\,{}^3S_1$		(−0.7)			$11p\,{}^2P^o$, +
2674	${}^3P^o_2 -\ {}^3S_1$	−0.3	−0.7	−0.4	+0.03	
2625	$6p\,{}^3P^o_2 - 12s\,{}^3S_1$	−0.1				$12p\,{}^3P^o$, +
4077	$6p\,{}^3P^o_1 -\ 7s\,{}^1S_0$	−0.01	−0.07	−0.06	+0.01	
2856	$6p\,{}^3P^o_1 -\ 8s\,{}^1S_0$	−0.1	−0.2	−0.1	+0.01	$8p\,{}^1P^o$, +
4916	${}^1P^o_1 -\ {}^1S_0$	−0.11	−0.07	+0.04	−0.01	
4108	$6p\,{}^1P^o_1 -\ 9s\,{}^1S_0$	−0.21	−0.74	−0.53	+0.09	$6p'\,{}^1P^o$, +
3801	$6p\,{}^1P^o_1 - 10s\,{}^1S_0$	0.0	0.0	+0.1	−0.01	$9p\,{}^1P^o$, −
3144	$6p\,{}^3P^o_1 -\ 7p\,{}^3P^o_2$		(−0.6)			$6d\,{}^3D$, +
3680	${}^3P^o_2 -\ {}^3P^o_2$		(−0.7)			
7091	$7s\,{}^3S_1 -\ 8p\,{}^3P^o_0$	−0.05	−0.47	−0.42	+0.21	$7d\,{}^3D$, +
7081	$7s\,{}^3S_1 -\ 8p\,{}^3P^o_1$	−0.05	−0.39	−0.34	+0.17	$7d\,{}^3D$, +
3049	$6p\,{}^3P^o_2 -\ 8p\,{}^3P^o_2$		(−1.6)			$7d\,{}^3D$, +
6907	$7s\,{}^3S_1 -\ 8p\,{}^3P^o_2$	(0.0)	(−0.5)	−0.5	+0.25	
5871	$7s\,{}^3S_1 -\ 9p\,{}^3P^o_0$	−0.05	−2.20	−2.15	+0.74	$8d\,{}^3D$, +
5859	$7s\,{}^3S_1 -\ 9p\,{}^3P^o_1$	−0.06	−1.05	−0.99	+0.34	$8d\,{}^3D$, +
2810	$6p\,{}^3P^o_2 -\ 9p\,{}^3P^o_2$?		(−2.7)			$8d\,{}^3D$, +
5354	$7s\,{}^3S_1 - 10p\,{}^3P^o_2$	(−0.5)	(−3.5)	−3.00	+0.86	$9d\,{}^3D$, +
5675	$7s\,{}^3S_1 -\ 9p\,{}^1P^o_1$	(−0.1)	(−0.1)	+0.06	−0.02	$10s\,{}^1S$, +
6234	${}^1S_0 -\ {}^1P^o_1$	(−0.3)	(−0.2)	+0.05	−0.02	$8d\,{}^1D$, −

(Table 2, cont.)

λ, Å	Combination	$\Delta\sigma$, K			$\Delta\lambda$, Å 70V–20V	Main perturbing term, sign of Stark shift $\Delta\lambda$
		20V–ref	70V–ref	70V–20V		
2967	$6p\,^3P^o_0-\ 6d\,^1D_2$	−0.1	+0.1	+0.2	−0.02	$7p\,^1P$, −
3131	$^3P^o_1-\ \ ^1D_2$	−0.1	−0.1	0.0	0.00	
3663	$^3P^o_2-\ \ ^1D_2$	0.0	0.0	0.0	0.00	
5790	$^1P^o_1-\ \ ^1D_2$	−0.01	+0.05	+0.06	−0.02	
2655	$6p\,^3P^o_1-\ 7d\,^1D_2$	−0.1	−0.2	−0.1	+0.01	$5f\,^1F$, +
3027	$^3P^o_2-\ \ ^1D_2$	−0.2	−0.3	−0.1	+0.01	$8p\,^1P$, −
4347	$^1P^o_1-\ \ ^1D_2$	−0.05	−0.15	−0.10	+0.02	
2483	$6p\,^3P^o_1-\ 8d\,^1D_2$	−0.2	−1.0	−0.8	+0.05	$6f\,^1F$, +
2806	$^3P^o_2-\ \ ^1D_2$	−0.1	−1.0	−0.9	+0.07	
3906	$^1P^o_1-\ \ ^1D_2$	−0.4	−1.7	−1.3	+0.20	
3704	$6p\,^1P^o_1-\ 9d\,^1D_2$	−0.2	−3.3	−3.1	+0.42	$7f\,^1F$, +
3592	$6p\,^1P^o_1-10d\,^1D_2$	(−0.6)				$8f\,^1F$, +
2967	$6p\,^3P^o_0-\ 6d\,^3D_1$	+0.1	−0.2	−0.2	+0.02	
3131	$^3P^o_1-\ \ ^3D_1$	0.0	−0.1	−0.1	+0.01	
3662	$^3P^o_2-\ \ ^3D_1$	−0.1	−0.2	−0.1	+0.01	
3125	$6p\,^3P^o_1-\ 6d\,^3D_2$	−0.1	+0.1	+0.2	−0.02	
3654	$^3P^o_2-\ \ ^3D_2$	+0.2	+0.3	+0.1	−0.01	
5769	$^1P^o_1-\ \ ^3D_2$	−0.02	+0.10	+0.12	−0.04	
3650	$6p\,^3P^o_2-\ 6d\,^3D_3$	0.0	+0.1	+0.1	−0.01	
2534	$6p\,^3P^o_0-\ 7d\,^3D_1$	−0.1	−0.1	0.0	0.00	$5f\,^3F$, +
2653	$^3P^o_1-\ \ ^3D_1$	+0.1	−0.3	−0.4	+0.03	
3025	$^3P^o_2-\ \ ^3D_1$	−0.3	−0.4	−0.1	+0.01	
2652	$6p\,^3P^o_1-\ 7d\,^3D_2$	0.0	−0.5	−0.4	+0.03	$5f\,^3F$, +
3023	$^3P^o_2-\ \ ^3D_2$	−0.2	−0.2	0.0	0.00	
4339	$^1P^o_1-\ \ ^3D_2$	−0.05	−0.32	−0.27	+0.05	
3021	$6p\,^3P^o_2-\ 7d\,^3D_3$	−0.3	−0.5	−0.2	+0.02	$5f\,^3F$, +
2378	$6p\,^3P^o_0-\ 8d\,^3D_1$	−0.2	−1.1	−0.9	+0.05	$6f\,^3F$, +
2482	$^3P^o_1-\ \ ^3D_1$	0.0	−0.8	−0.8	+0.05	
2805	$^3P^o_2-\ \ ^3D_1$	0.0				
3903	$^1P^o_1-\ \ ^3D_1$	(−0.2)				
2481	$6p\,^3P^o_1-\ 8d\,^3D_2$	−0.1	−1.1	−1.0	+0.06	$6f\,^3F$, +
2804	$^3P^o_2-\ \ ^3D_2$	−0.4	−1.0	−0.6	+0.05	
3901	$^1P^o_1-\ \ ^3D_2$	−0.2	−1.5	−1.3	+0.20	
2803	$6p\,^3P^o_2-\ 8d\,^3D_3$	0.0	−1.2	−1.2	+0.09	$6f\,^3F$, +
2302	$6p\,^3P^o_0-\ 9d\,^3D_1$	−0.4	−2.3	−1.9	+0.10	$7f\,^3F$, +
2399	$^3P^o_1-\ \ ^3D_1$	−0.2				

(Table 2, cont.)

λ, Å	Combination	$\Delta\sigma$, K			$\Delta\lambda$, Å 70V–20V	Main perturbing term, sign of Stark shift $\Delta\lambda$
		20V–ref	70V–ref	70V–20V		
2399	$6p\,^3P_1^o-\ 9d\,^3D_2$	-1.7				$7f\,^3F$, +
2699	$^3P_2^o-\ \ ^3D_2$	-1.7				
3701	$^1P_1^o-\ \ ^3D_2$	(-0.4)				
2698	$6p\,^3P_2^o-\ 9d\,^3D_3$	-0.3				$7f\,^3F$, +
2258	$6p\,^3P_0^o-10d\,^3D_1$	(-0.6)				$8f\,^3F$, +
2352	$6p\,^3P_1^o-10d\,^3D_2$	(-0.5)	(-2.0)	-1.5	$+0.08$	$8f\,^3F$, +
2639	$6p\,^3P_2^o-10d\,^3D_3$	-0.5				$8f\,^3F$, +
2603	$6p\,^3P_2^o-11d\,^3D_3$	(-1.1)				$9f\,^3F$, +
3038	$6p\,^3P_2^o-\ 6p'\,^3F_4^o$?		(-0.4)			$7d\,^3D$, +
3011	$6p\,^3P_2^o-\ 5f\ \,^3F_3^o$?		$(+0.3)$			$7d\,^3D$, −
3007	$6p\,^3P_2^o-\ 5f\ \,^3F_4^o$?		$(+0.5)$			$7d\,^3D$, −
6123	$7s\ ^3S_1-\ 6p'\,^1D_2^o$	(-0.2)	(-0.2)	0.0	0.00	
6072	$7s\ ^3S_1-\ 6p'\,^1P_1^o$	(0)	(0)	-0.1	$+0.05$	$8d\,^1D$, +
6716	$^1S_0-\ \ ^1P_1^o$	(0)	(0)	-0.1	$+0.05$	
3894	$6p\,^1P_1^o-\ 6f\ \,^3F_2^o$?		(-2.5)			$5g\,^3G$?, + $8d\,^3D$, −

made at 20 V, with and without an external reference spectrum, and two similar exposures at 70 V. Parts of some typical spectrograms are reproduced in Plate I. The reference spectrum was obtained from an iron arc, which was projected on the slit of the spectrograph through the same condenser lens as was used for the mercury arc. In the region above 6200 Å a neon Geissler tube placed directly in front of the slit was used for standards. The region from 3000 to 7091 Å was photographed in the first order and the region from 2258 to 4400 Å in the second order of the Jarrell-Ash spectrograph. Owing to the appreciable width of many of the lines the accuracy was in general limited by this width rather than by the dispersion of the spectrograph.

The measured wavelengths are tabulated in Table 1 together with the results of some previous measurements, the majority of which are from Burns, Adams and Longwell (1950). It is seen from the table that most of the lines were displaced towards longer wavelengths when the intensity of the arc was increased by raising the voltage. These lines are often displaced already at the low intensity when compared with Burns, Adams and Longwell's values. In a few cases a displacement occurred towards shorter wavelengths. All the lines measurable at the higher voltage are included in the table, though they were not all found in the recordings at the lower voltage. For some lines, which were too diffuse to be measured at 70 V, only the wavelengths at 20 V are given.

In Table 2, the lines due to transitions from the same upper energy level have been grouped together. In most cases the displacements of the lower levels can be assumed to be negligible. The wave-number displacements for transitions from the same upper level then ought to be equal. From the table we find that this condition as a rule is fulfilled within the limits of error of the measurements. The estimated errors vary with the sharpness of the lines and the number of measurements, but in general they will not exceed 0.02 Å. In a few cases remarkably large irregularities occur, but then the spectrum lines are very broad and diffuse, and the errors of measurement probably exceed 0.02 Å.

The reference wave-numbers entering in the differences marked 20V − ref and 70V − ref in Table 2 have been obtained from precision measurements made with a light source that should give lines which may be regarded as undisturbed. The corresponding wavelengths are those given in column 1 of Table 1. When there are no suitable references of this kind, the wave-numbers have been calculated from the data in Atomic Energy Levels Vol. III (1958). In these cases, the wave-number differences are given within brackets.

The direction in which the Stark effect may be expected to change the wavelength is noted in the last column of Table 2, a plus sign indicating a shift towards longer wavelengths. The term which can be assumed to have the greatest influence on the displacement of the upper level in each case is also given. One finds that most of the displacements may be qualitatively explained by the Stark effect. Some forbidden transitions, which only occur at the higher voltage, have presumably been induced by the Stark effect. When studying the spectrograms, one also finds that a large wavelength displacement and a substantial line broadening appear simultaneously.

The present investigation has provided, in addition to the wavelengths needed for the dispersion measurements, useful information concerning the stability and width of the various lines, which has helped to select suitable lines for the dispersion work. As the mercury arc has been much used, and may still be used, in similar investigations, it has been considered worth while to make these results available by publishing the present report.

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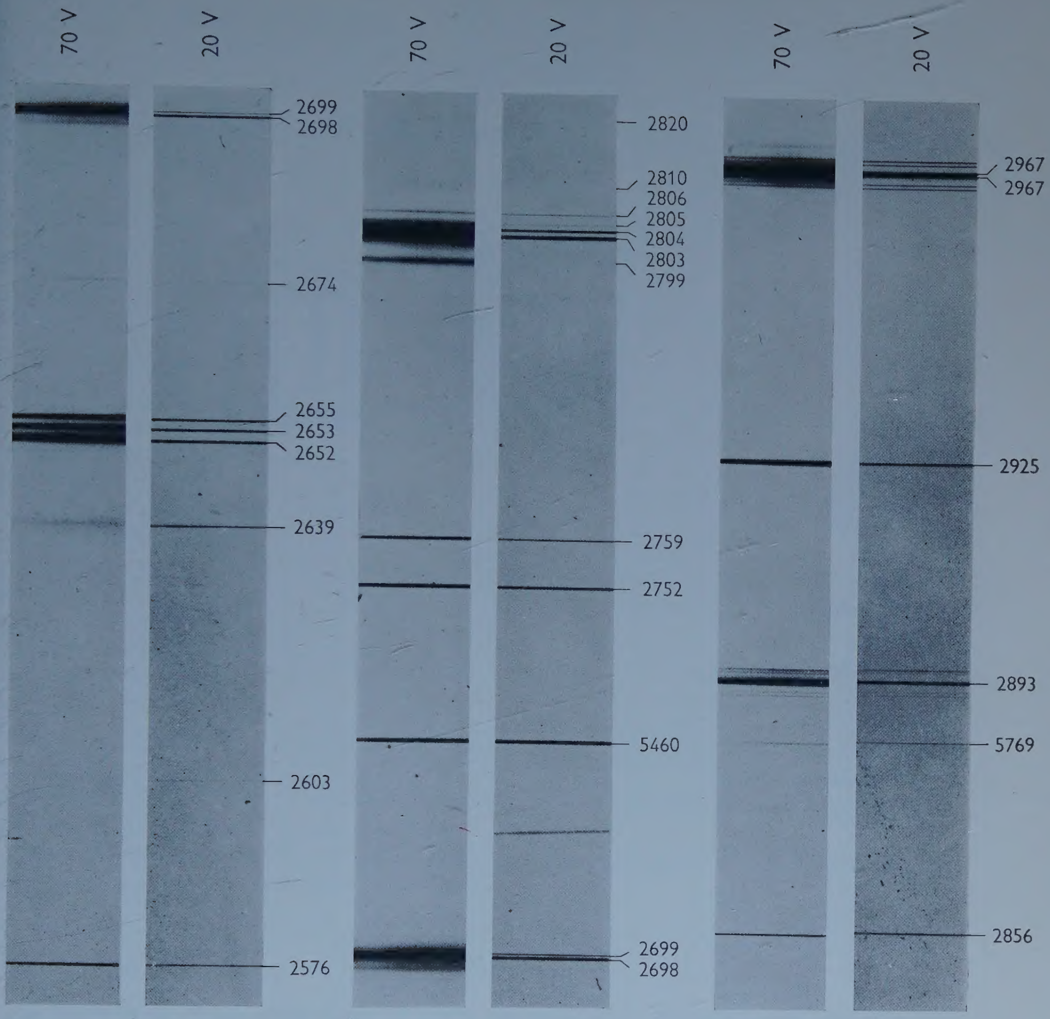

Spectrograms obtained at 20 V and 70 V. Wavelengths given in Å in air. (Magnification 2.3 times.)